This document contains Part 1 (pp.105–114) of Chapter 4 of the National Coastal Condition Report III.

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National Coastal Condition Report III

Chapter 4: Southeast Coast Coastal Condition

Part 1 of 2

December 2008

CHAPTER 4

Southeast Coast Coastal Condition

Courtesy of Brad Ashbaugh

Southeast Coast Coastal Condition

As shown in Figure 4-1, the overall coastal condition of the Southeast Coast region is rated fair, with an overall condition score of 3.6. The water quality, sediment quality, and coastal habitat indices for the region are rated fair; the benthic index is rated good; and the fish tissue contaminants index is rated good to fair. Figure 4-2 provides a summary of the percentage of coastal area in good, fair, poor, or missing categories for each index and component indicator. This assessment is based on environmental stressor and response data collected by the NCA, in collaboration with state resource agencies, from 294 locations throughout Southeast Coast coastal waters using comparable methods and techniques. Please refer to Chapter 1 for information about how these assessments were made, the criteria used to develop the rating for each index and component indicator, and the limitations of the available data.

The Southeast Coast region contains a wealth of resources, including barrier islands such as North Carolina's Outer Banks; busy shipping ports in Miami and Jacksonville, FL, Savannah, GA, and Charleston, SC; quiet coastal wetlands that provide a habitat for migratory birds and other animals; and important commercial and recreational fishery resources. The coastal resources of this region are diverse and extensive, covering an estimated 4,487 mi^2. The provinces of this region include the Carolinian Province, which extends from Cape Henry, VA, through the southern end of the Indian River Lagoon, as well as part of the West Indian Province along the east coast of Florida from the Indian River Lagoon through Biscayne Bay. The borders of the Southeast Coast region roughly coincide with the borders of the Southeast U.S. Continental Shelf LME. Also included in the Southeast Coast region is North Carolina's Albemarle-Pamlico Estuarine System, one of the largest and most productive aquatic systems in North America. The Albemarle-Pamlico system represents North Carolina's key resource base for commercial fishing, recreational fishing, and tourism. Similarly, the coastal resources of other Southeast Coast states provide the resource base

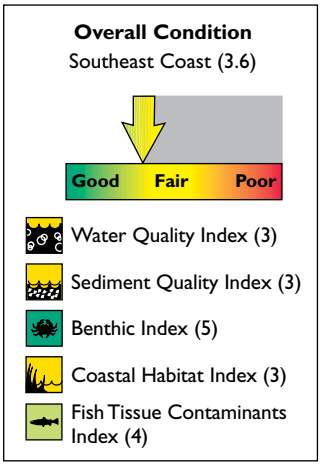


Figure 4-1. The overall condition of Southeast Coast coastal waters is rated fair (U.S. EPA/NCA).

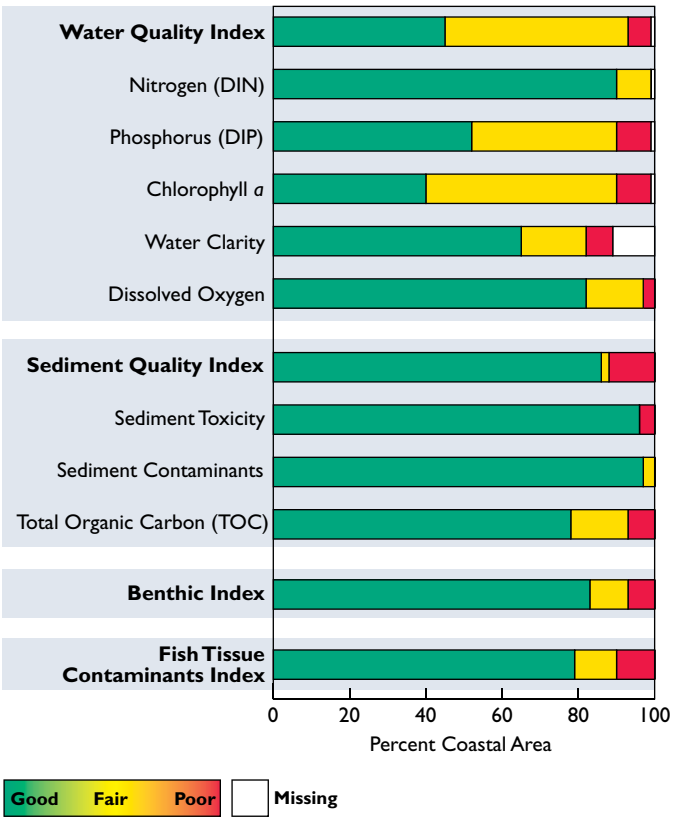


Figure 4-2. Percentage of coastal area achieving each ranking for all indices and component indicators—Southeast Coast region (U.S. EPA/NCA).

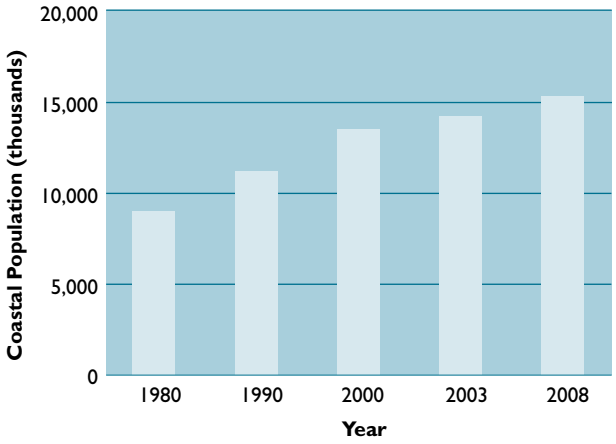


Figure 4-3. Actual and estimated population of coastal counties in Southeast Coast states, 1980–2008 (Crossett et al., 2004).

for fishing and tourism industries and generate vast amounts of sales tax income for those states.

Between 1980 and 2003, coastal counties of the Southeast Coast region showed the largest rate of population increase (58%) of any coastal region in the conterminous United States. Florida was largely responsible for this growth, with a population increase of 7.1 million people, or 75%, during this time period. Figure 4-3 presents population data for the Southeast Coast region's coastal counties and shows that these populations have increased significantly since 1980 (Crossett et al., 2004). There is evidence of human-induced stress in some areas of the Southeast Coast region. Given the influx of people and businesses to southeastern coastal states and the ensuing pressures on the coastal zones of this region, there is an increased need for effective management of the region's resources.

Coastal Monitoring Data—Status of Coastal Condition

Several programs have monitored the coastal waters of the Southeast Coast region, including NOAA's NS&T and EPA's EMAP Carolinian Province. EPA's NCA began partnerships with coastal states in this region in 1999 (South Carolina), 2000 (Georgia, Florida), and 2001 (North Carolina). Sampling sites were chosen randomly to represent larger spatial scales. Participating state partners sampled waters during the summer, when conditions were expected to be most stressful (i.e., experiencing low dissolved oxygen levels). This probabilistic sampling approach enabled comparison within and across state boundaries and allowed for the presentation of data in terms of percentages of coastal area rated good, fair, and poor.

Water Quality Index

The water quality index for the coastal waters of the Southeast Coast region is rated fair, with only 6% of the coastal area rated poor and 48% of the area rated fair for water quality condition (Figure 4-4). The water quality index was developed based on measurements of five component indicators: DIN, DIP, chlorophyll *a*, water clarity, and dissolved oxygen.

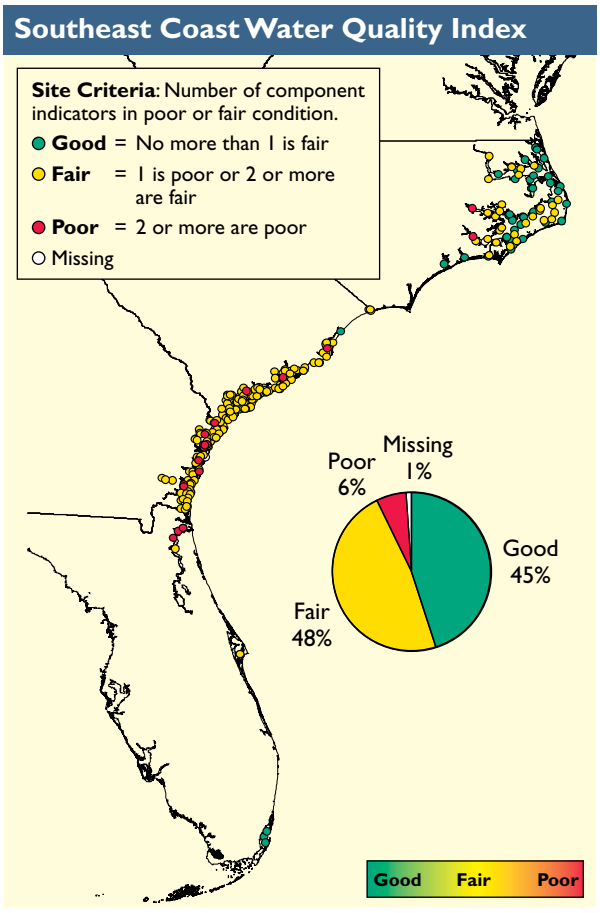
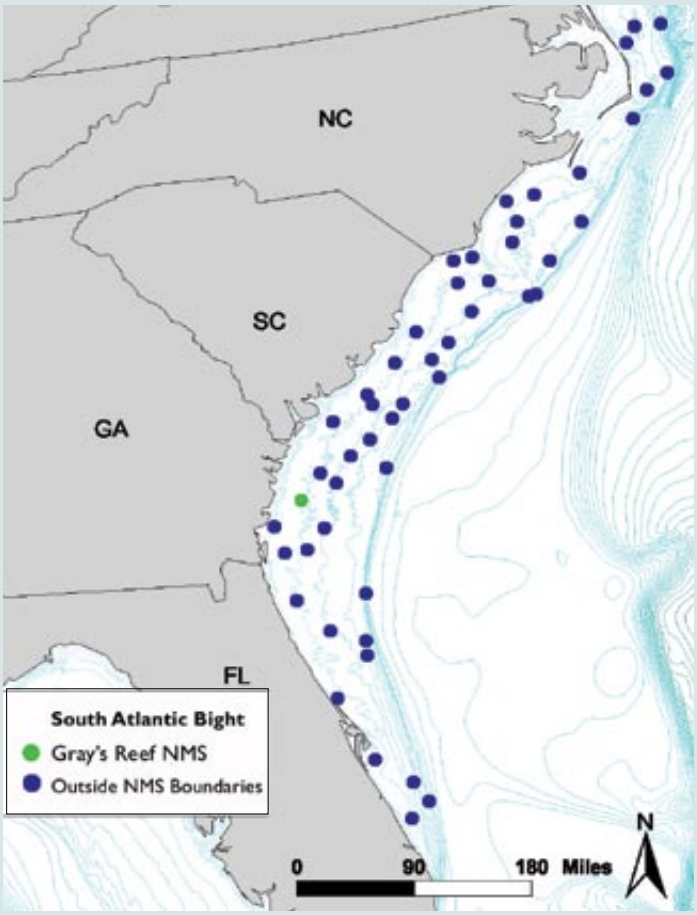


Figure 4-4. Water quality index data for the Southeast Coast coastal waters (U.S. EPA/NCA).

Highlight

EPA, NOAA, and Southeastern States Assess Ecological Condition in Near-Coastal Shelf Waters of the South Atlantic Bight

A study is under way by EPA, NOAA, and partnering southeastern states to assess the condition of aquatic resources throughout near-coastal shelf waters of the South Atlantic Bight (SAB). This SAB study may be regarded as an extension of previous EMAP efforts in estuaries and inland waters to these offshore areas, where such information has been limited in the past. A similar effort is also under way in shelf waters along the western coast of the United States (see Chapter 6, *West Coast Coastal Condition*). The SAB sampling effort applies EMAP's probabilistic sampling approach to support statistical estimation of the spatial extent of conditions with respect to various measured ecological indicators. The results of this study are intended to serve as a baseline for monitoring potential changes in these indicators over time due to either human or natural factors.



South Atlantic Bight sampling sites (Cooksey, 2004).

Sampling was conducted in April 2004 at 50 random stations (see map) from Nags Head, NC, to West Palm Beach, FL, at depths of about 32.8–328 feet (roughly from just offshore to the outer edge of the continental shelf). Data from these 50 stations will allow the assessment of conditions for the SAB offshore region and contribute to broader estimates of conditions at the national level. In addition, a station was included within the Gray's Reef NMS located off the coast of Georgia (Cooksey, 2004). NOAA also has conducted recent site-intensive surveys of condition at multiple stations within the boundaries of the Gray's Reef NMS, using the same protocols as in the present SAB-wide survey (Cooksey et al., 2004; Hyland et al., 2006). Thus, results of these companion surveys (the first conducted in 2000, and the second conducted in 2005) can be integrated with the present regional survey to assess the condition of sanctuary resources within the context of the broader SAB ecosystem.

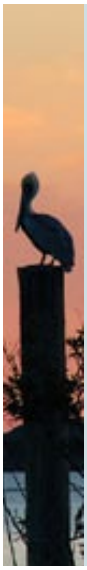
As in other EMAP efforts (including the present NCCR III), multiple indicators were measured synoptically at each station to support weight-of-evidence assessments of condition and the examination of associations between biological characteristics and potential environmental controlling factors (U.S. EPA, 2002). Condition was assessed using indicators of (1) habitat condition, (2) general water quality, (3) biological condition with a focus on benthic infauna and demersal (bottom-dwelling) fish pathology, and (4) exposure to stressors. The table lists the specific indicators assessed during this study.

Environmental Indicators Used in the SAB Study (Cooksey, 2004)
Habitat Condition Indicators
Salinity
Water depth
Dissolved oxygen
pH
Water temperature
Total suspended solids
Transmittance
Sediment grain size
Sediment percent total organic carbon (TOC)
Sediment color/odor
Presence of trash/marine debris
Water Quality Indicators
Chlorophyll *a* concentrations
Nutrient concentrations (nitrates, nitrites, ammonia, phosphate)
Biological Condition Indicators
Benthic species composition
Benthic abundance
Benthic species richness and diversity
External indicators of disease in fish
Presence of nonindigenous species
Exposure Indicators
Chemical contaminants in sediment
Chemical contaminants in fish tissues
Low dissolved oxygen condition
Organic over-enrichment

The consistent and systematic sampling of the different biological and environmental variables across such a large pool of stations provides a tremendous opportunity for learning more about the spatial patterns of these near-coastal aquatic resources and the processes controlling their distributions, including potential associations between the presence of stressors and biological responses. For example, a key environmental concern that the program will address with these data is the extent to which pollutants and other materials are being transported out of major rivers located along the developed areas of the coast. Another concern is how these pollutants may affect biological resources.

The study also demonstrates the benefits of performing science through partnerships that bring together complementary capabilities and resources from a variety of federal, state, and academic institutions. The project is principally funded by the EPA Office of Research and Development. NOAA also is a major partner in the effort, working with EPA to provide overall management and interpretive support, in addition to contributing ship time on the NOAA Ship *Nancy Foster*. State and academic partners include the North Carolina Department of Environment and Natural Resources, South Carolina Department of Natural Resources (DNR), Georgia DNR, Florida Department of Fish and Wildlife, and the College of Charleston.

A final report is expected by March 2009. It is anticipated that the resulting information on the condition of ecological resources in these deeper near-coastal waters will make a valuable contribution to future NCCRs.



The sampling conducted in the EPA NCA survey has been designed to estimate the percent of estuarine area (nationally or in a region or state) in varying conditions and is displayed as pie diagrams. Many of the figures in this report illustrate environmental measurements made at specific locations (colored dots on maps); however, these dots (color) represent the value of the index specifically at the time of sampling. Additional sampling would be required to define temporal variability and to confirm environmental condition at specific locations.

Nutrients: Nitrogen and Phosphorus

The Southeast Coast region is rated good for DIN concentrations because less than 1% of the region's coastal area was rated poor and 9% of the area was rated fair for this component indicator. The Southeast Coast region is also rated good for DIP concentrations, with only 9% of the coastal area rated poor and 38% of the area rated fair for this component indicator.

Chlorophyll a

The Southeast Coast region is rated fair for chlorophyll *a* because 59% of the coastal area was rated fair and poor, combined, for this component indicator.

Water Clarity

Water clarity in the Southeast Coast region is rated good, with 17% of the coastal area rated fair and 7% of the area rated poor for this component indicator. The criteria used to assign water clarity ratings varied across Southeast Coast coastal waters, based on natural variations in turbidity levels and local waterbody management goals (see Chapter 1 for additional information). The box shows the criteria for rating a site in poor condition for water clarity in estuarine systems with differing levels of natural turbidity.

Coastal Areas	Criteria for a Poor Rating (Percentage of Ambient Light that Reaches 1 Meter in Depth)
Indian River Lagoon Estuarine System	< 20%
Albemarle-Pamlico and Biscayne Bay estuarine systems	< 10%
All Remaining Southeast Coast estuarine systems	< 5%

The NCA monitoring data used in this assessment were based on single-day measurements collected at sites throughout the U.S. coastal waters (excluding the Great Lakes) during a 9- to 12-week period in late summer. Data were not collected during other time periods.

Dissolved Oxygen

The Southeast Coast region is rated good for dissolved oxygen concentrations, with 15% of the coastal area rated fair and 3% of the area rated poor for this component indicator.

Sediment Quality Index

The sediment quality index for the coastal waters of the Southeast Coast region is rated fair, with 2% of the coastal area rated fair and 12% of the area rated poor for sediment quality condition (Figure 4-5). The sediment quality index was calculated based on measurements of three component indicators: sediment toxicity, sediment contaminants, and sediment TOC.

Sediment Toxicity

The Southeast Coast region is rated good for sediment toxicity, with 96% of the area rated good and approximately 4% of the coastal area rated poor for this component indicator.

Sediment Contaminants

The Southeast Coast region is rated good for sediment contaminant concentrations, with approximately 3% of the coastal area rated fair and less than 1% of the area rated poor for this component indicator.

Sediment TOC

The Southeast Coast region is rated good for sediment TOC concentrations, with 15% of the coastal area rated fair and only 7% of the area rated poor for this component indicator.

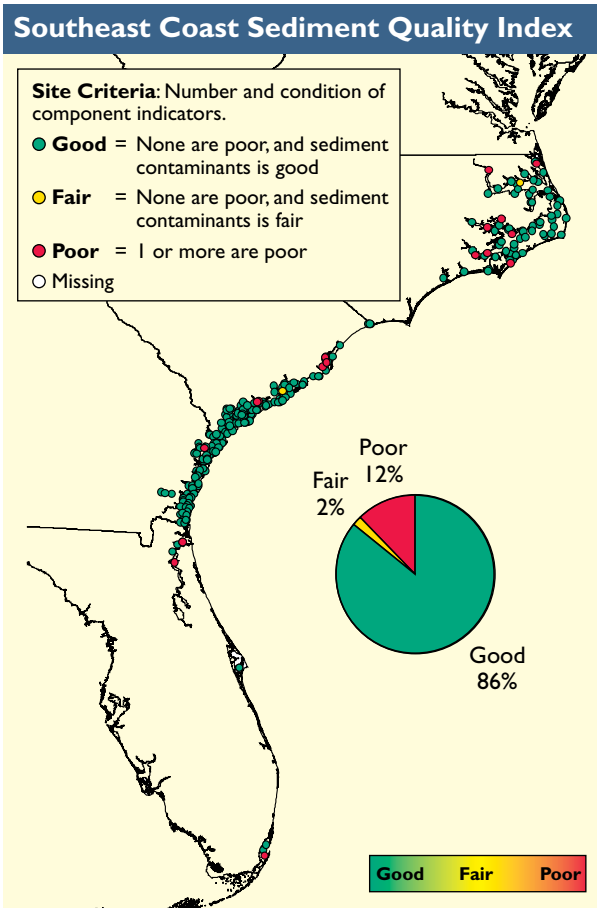


Figure 4-5. Sediment quality index data for Southeast Coast coastal waters (U.S. EPA/NCA).

Benthic Index

The biological condition of the coastal waters of the Southeast Coast region, as measured by the Southeast Coast Benthic Index, is rated good. Van Dolah et al. (1999) developed the benthic index based on several measures of benthic community condition, including the total number of species and integrated measures of species dominance, species abundance, and abundance of pollution-sensitive taxa. The index shows that 83% of the Southeast Coast region's coastal area was rated good for benthic condition, 10% of the area was rated fair, and 7% of the area was rated poor (Figure 4-6). Stations rated poor were located in portions of the Neuse River in North Carolina and Medway River in Georgia.

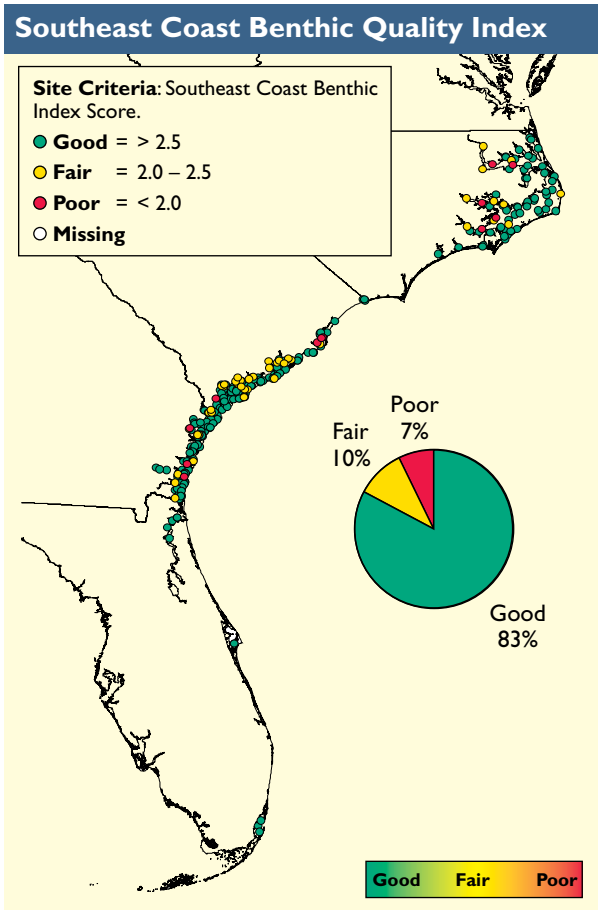


Figure 4-6. Benthic index data for Southeast Coast coastal waters (U.S. EPA/NCA).

Highlight

Georgia's Marsh Dieback

In March 2002, areas of dying coastal salt marshes were reported to the Georgia DNR Coastal Resource Division (CRD), who confirmed that dying marsh grasses (*Spartina alterniflora* and *Juncus roemerianus*) were resulting in open mudflats. The affected areas initially reported to the CRD were located in Liberty County and included several miles of creekside marsh die-off, as well as acres of receding marsh along the Jericho River. Since 2002, areas of dead and dying marsh have been reported in all six of Georgia's coastal counties, from the St. Mary's River in Camden County to Tybee Island in Chatham County. The CRD has consulted with other states that have experienced similar marsh epidemics (e.g., South Carolina, Louisiana), but the causes of the die-off in Georgia have not yet been determined. An estimated 1,000 acres of marsh have been affected, with the vast majority of this acreage located in Liberty County (Georgia DNR, 2003).

The CRD has collaborated with scientists from Savannah State University, the Sapelo Island NERR, the Gray's Reef NMS, Georgia Sea Grant, the U.S. Army Corps of Engineers (USACE), the University of Georgia Marine Extension Service, the University of Georgia Marine Institute, and the Skidaway Institute of Oceanography to collect data from the dying marsh sites via the Georgia Coastal Research Council (GCRC). Quarterly field sampling has been conducted using a standardized methodology developed by CRD and GCRC scientists. These marsh samples were analyzed for soil and interstitial salinities, the presence of fungi and/or abnormal bacteria, and pH. Although higher-than-normal salinities were detected, these levels were not high enough to denude the amount of marsh that has been lost. No other abnormal readings have been detected. Researchers are continuing field sampling to monitor and evaluate changes in salinities and vegetation (Georgia DNR, 2003).

In addition, Savannah State University has established a working laboratory for testing vegetation samples. Greenhouse trials were conducted to determine the effects of fresh water and examine the variation in soils. Initial results of these trials have shown no difference between the *Spartina* plants that were grown in soils from the die-off areas and those grown in healthy marsh soils. *Spartina* leaves revealed no abnormal species counts; however, root and rhizome analyses are ongoing (Georgia DNR, 2003).

In response to the marsh die-off, the CRD has coordinated outreach and research activities. Outreach activities included responding to concerned citizen reports and developing press releases for local media. The CRD is also cataloging all reports of dying marshes through aerial and on-the-ground photographic documentation and using GIS software to map and estimate the affected acreage. In collaboration with GIS specialists from the University of Georgia Marine Extension Service, the CRD is planning and implementing GIS classifications to delineate and track die-off areas. Scientists from the GCRC have applied for various grants to address certain aspects of the marsh die-off, including monitoring, transplant experiments, and plant tissue analysis studies (Georgia DNR, 2003).

The marsh die-off affects a vital coastal area of Georgia and has implications for wildlife, fisheries, water quality, navigation, and flood control. Under the Georgia Coastal Marshlands Protection Act (O.C.G.A. 12-5-280 et seq.), the State of Georgia recognizes that "the coastal marshlands of Georgia comprise a vital natural resource system. The estuarine area…is the habitat of many species of marine life and wildlife and, without the food supplied by the marshlands, such marine life and wildlife cannot survive. The estuarine marshlands of coastal Georgia are among the richest providers of nutrients in the world. Such marshlands provide a nursery for commercially and recreationally important species of shellfish and other wildlife, provide a great buffer against flooding and erosion, and help control and disseminate pollutants. The coastal marshlands provide a natural recreation resource, which has become vitally linked to the economy of Georgia's coastal zone and to that of the entire state. This…system is costly, if not impossible, to reconstruct or rehabilitate once adversely affected." The results of these investigations into the dead marsh issue have long-term implications for the preservation of Georgia's estuaries and the health of Georgia's coastal economy (Georgia DNR, 2003).

Updates regarding the progress made on the marsh die-off issue can be found at the GCRC Web site at http://www.gcrc.uga.edu or accessed through the CRD Web site at http://crd.dnr.state.ga.us.

Aerial survey of marsh dieback, Jerico River, GA (courtesy of Matt Ogburn, GCRC).

Coastal Habitat Index

The coastal habitat index for the coastal waters of the Southeast Coast region is rated fair. As reported in the NCCR II (U.S. EPA, 2004a), wetlands in the Southeast Coast region diminished from 1,107,370 acres in 1990 to 1,105,170 acres in 2000, representing a loss of 2,200 acres or 0.2%.

Fish Tissue Contaminants Index

The fish tissue contaminants index for the coastal waters of the Southeast Coast region is rated good to fair. Fish tissue samples were collected at 218 of the 294 NCA sampling sites (74%) in the Southeast Coast region. Figure 4-7 shows that 10% of all sites sampled where fish were caught were rated poor using whole-fish contaminant concentrations and EPA Advisory Guidance values. Total PAHs and total PCBs were the only contaminants with elevated concentrations in fish tissues collected from Southeast Coast coastal waters.

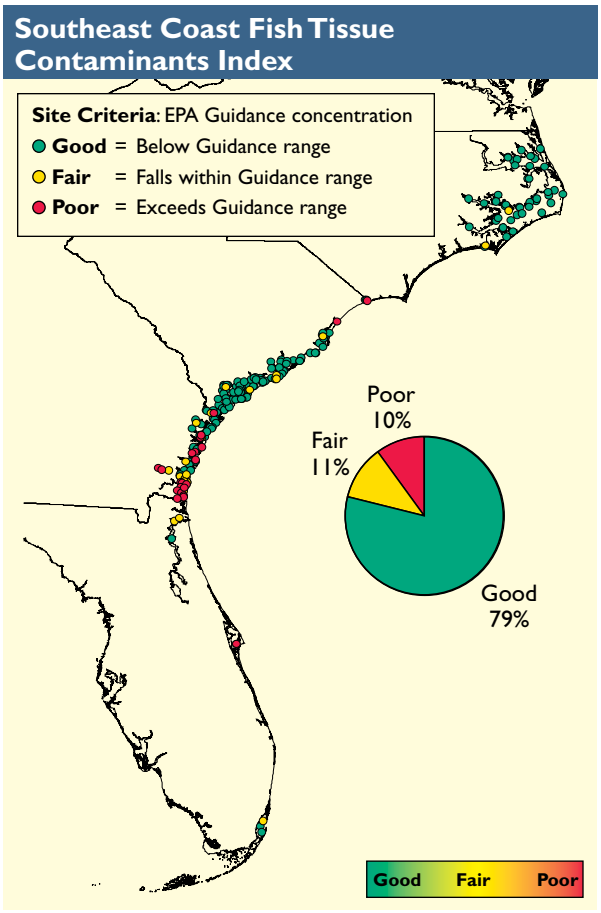


Figure 4-7. Fish tissue contaminants index data for Southeast Coast coastal waters (U.S. EPA/NCA).

Intracoastal Waterway, Onslow County, NC (courtesy of Kimberly Matthews).